UCLouvain

lelec2753

2017

Electrical Power Systems: Advanced Topics

5 credits	30.0 h + 15.0 h	Q2

Teacher(s)	De Jaeger Emmanuel ;
Language :	English
Place of the course	Louvain-la-Neuve
Main themes	• Dynamic modelling, control and analysis of transient behaviour of power systems, especially in the significant presence of power generation units from renewable sources (wind, photovoltaic, marine and others) • Applications of power electronics to the management of electrical energy and power grids, in particular (transmission networks: Flexible AC Transmission Systems (FACTS), DC link (HVDC); distribution networks (D-FACTS, active filters)) • Smart Grids: active demand management, energy storage, management of the massive integration of distributed generation in distribution networks, evolution of the concept of ancillary services, micro-grids, power systems monitoring and automation.
Aims	In consideration of the reference table AA of the program "master in electrical engineering ", this course contributes to the development, to the acquisition and to the evaluation of the following experiences of learning: • AA1.1, AA1.2, AA1.3 • AA3.1, AA3.3 • AA5.6 • AA6.1 Specifically, at the end of the course, students will be able to: 1 • Model electrical power systems and study their dynamic behaviour, especially with the help of specialized software tools, • Explain electrical features and dynamic models of electricity generating units from renewable sources, • Explain the characteristics, features and models of power electronic systems used to manage the transmission and distribution of electricity, • Understand the technical challenges for electric power systems, anticipating and resolving issues related to the increasing electrical power generation from renewable energy sources. Transversal learning outcomes: • Use of specialized software tools • Address the question of the changing energy landscape, particularly the role of renewable energies and the new challenges linked to them (to be taken up by the various actors in the power systems) - - - - *The contribution of this Teaching Unit to the development and command of the skills and learning outcomes of the programme(s) can be accessed at the end of this sheet, in the section entitled "Programmes/courses offering this Teaching Unit".*
Evaluation methods	Students are assessed during an oral examination, for which they can have the courses and their personal notes supports. The examination mark accounts for 50% of the final grade. The marks of small projects made during the semester account for 50% of the final grade.
Teaching methods	• Lectures for the introduction of the basic theoretical concepts and general context description • Exercises (projects): solving particular problems with the help of dedicated software tools. Discussion forum, practical issues concerning the use of software tools and results. Consulting sessions (coaching).
Content	• Generalities, a reminder of basic concepts of electricity networks • Dynamic modelling of systems: 1. Synchronous machines (Park's model, simplified models, characteristic parameters), 2. Wind turbine generators (cage induction motors, doubly-fed induction machines, permanent magnet synchronous machines and associated power electronic converters), 3. Photovoltaic systems, 4. Power electronics converters used in the technical management and operation of energy networks: HVDC links, FACTS, 5. Other network components and loads, 6. Energy Storage Systems.

	• Introduction to the concepts of stability • Introduction and use of specialized software tools for the analysis of the dynamic behaviour of electrical systems • Smart Grids: current issues (technical management of networks (congestion, stability, voltage control ...), ancillary services, the role of energy storage etc.)
Inline resources	Moodle http://moodleucl.uclouvain.be/course/view.php?id=5473
Bibliography	• P. Kundur, Power System Stability and Control, McGraw-Hill Inc. • Transparents du cours • Recueil de documentation
Other infos	It is recommended to have previously completed the course LELEC2520 or an equivalent According to the opportunities and practical availability, the course can be completed by a technical visit and / or seminars given by experts from industry
Faculty or entity in charge	ELEC

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Aims
Master [120] in Electro-mechanical Engineering	ELME2M	5		
Master [120] in Electrical Engineering	ELEC2M	5		